

FORESTRY DEPARTMENT

The Pennsylvania State College

# THE HAWAIIAN FORESTER AND AGRICULTURIST

DECEMBER, 1917

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VOL. XIV.

PRICE, TEN CENTS

NO. 12

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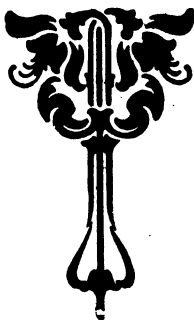
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# The Hawaiian Forester and Agriculturist

A Monthly Magazine of Forestry,  
Entomology, Animal Industry  
and Agriculture.

Issued under the direction of the Board  
of Commissioners of Agriculture  
and Forestry, Territory of Hawaii.



Address all communications to  
**DANIEL LOGAN**  
Editor "THE FORESTER"  
P. O. Box 366, Honolulu, T. H.

For business relating to subscriptions  
or advertising, address  
**HAWAIIAN GAZETTE CO., LTD.,**  
Publishers, Honolulu, T. H.

Price 10c. per copy; \$1.00 a year; Foreign, \$1.25  
Entered as second-class matter at the Post Office at Honolulu, Hawaii.

# Board of Agriculture and Forestry

## DIVISION OF FORESTRY.

### FOREST AND ORNAMENTAL TREE SEED AND SEEDLINGS FOR SALE AT THE GOVERNMENT NURSERY.

The Division of Forestry keeps constantly on hand at the Government Nursery, seed and seedlings of the important native and introduced trees. These are sold at prices just covering the cost of collection or growing.

The list includes both forest and ornamental trees, such as Silk Oak, Koa, various species of Eucalyptus, Golden and Pink Showers, Pride of India, Poinciana, Albizzia, etc. The price of the seed varies from 10 to 50 cents per ounce. The seedlings may be had for 2½ cents each, except a few kinds which are 5 cents. Seed of the various palms is also for sale, the price per 100 varying from \$1.00 to \$2.50. All seed is tested before being sent out, which insures its being good.

All communications in regard to seed or trees should be addressed to David Haugh, Forest Nurseryman, Box 207, Honolulu, Hawaii.

C. S. JUDD,  
Superintendent of Forestry.

## DIVISION OF ENTOMOLOGY.

To give information about insects free of charge is one of the duties of this Division, and Hawaiian readers are hereby invited to make inquiry in person and by mail. In order to be able to advise intelligently or send the right kind of useful insects for relief, we like and sometimes it is indispensable for us to see the insects suspected or caught in the act, also specimens of the injury. In a tin with a hole or two, or a wooden box, specimens may be mailed by parcels post. When specimens are not accompanied by letter, always write your name and address in the upper left-hand corner of the package. Address all communications, SUPERINTENDENT DIVISION OF ENTOMOLOGY, P. O. BOX 207, HONOLULU, HAWAII.

EDW. M. EHRHORN,  
Superintendent of Entomology.

## PUBLICATIONS FOR DISTRIBUTION.

The Board of Commissioners issues for general distribution to persons in the Territory, annual reports, bulletins, circulars, copies of its rules and regulations, and other occasional papers, which may be had, free, upon application.

A complete list of the publications of the Board available for distribution (together with the titles of certain issues now out of print) is to be found on the cover of the last biennial report.

Applications for publications should be addressed to the Mailing Clerk, P. O. Box 207, Honolulu, Hawaii.

# THE HAWAIIAN FORESTER AND AGRICULTURIST

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VOL. XIV.

HONOLULU, DECEMBER, 1917.

No. 12

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Although the number of trees distributed from the government nurseries for planting out on Arbor Day, which this year was celebrated on November 16, fell somewhat below the average and amounted to a total of only 12,111 trees, general interest in tree planting is still great as indicated by the fact that the Government Nursery has at present on file orders for 265,000 seedlings to be delivered within the next two months. Those who have chiefly celebrated Arbor Day in the past, viz., school children, residents of army posts, and homesteaders, have already planted up on past Arbor Days most of the available areas at their disposal and so the demand for trees for planting on Arbor Day will probably not increase in the future.

The new buildings for the Division of Plant Inspection on Ke-  
kuanaoa street are almost completed and Chief Plant Inspector Ehrhorn expects to move into the new quarters with his staff before the end of the year. They are of reinforced concrete, fire-proof, and built according to modern ideas so as to facilitate the important work of plant inspection and fumigation to prevent injurious insects from gaining a foothold here.

Entomologist Fullaway continues to breed out, in addition to the parasites on the fruit fly, large quantities of the corn leaf hopper parasite, sending out for liberation in cornfields on Oahu and Maui a total of 13,500 during November. This parasite is already reported as doing very efficient work.

The testing of dairy animals for bovine tuberculosis by the Territorial Veterinarian and his assistants continues in the effort to reduce greatly if not entirely eliminate this obnoxious disease. Of the 178 animals tested during November all but 6 per cent were passed as free from the disease.

On account of ill health Deputy Territorial Veterinarian H. B. Elliot has been granted leave without pay for one year beginning December 1. Dr. O. B. Shipman will serve as his substitute on Hawaii during his absence.

Lieut. A. T. Longley, on receiving his commission with the U. S. Army, has been granted a leave of absence from the position of Superintendent of the Marketing Division for the duration of the war.

## Division of Forestry

Board of Commissioners of Agriculture and Forestry.

Honolulu, December 12, 1917.

GENTLEMEN:—I respectfully submit the following routine report of the Division of Forestry for the month of November, 1917:

### KAUAI TRIP.

During the first three days of the month I was still on Kauai investigating several forest matters. In company with Forest Ranger Hosea K. Lovell I went over a large part of his district inspecting his work and instructing him in his future duties. The trees which he has been planting on the Kamalomalo flats on government land within the Kealia forest reserve are doing nicely and I pointed out to him the method by which this planting should be continued. A fence along the boundary of the Moloaa forest reserve was found to be in need of repair and upon investigation the matter was called to the attention of the holder of the lease which requires that this fence be maintained in good condition.

The boundaries of the proposed new forest reserve on the makai land of Wailua to include the Nonou ridge, where there yet remains a remnant of good native forest in need of protection for water conservation purposes, were thoroughly gone over and found to include the land which it is desirable to set apart.

### TREE PLANTING.

Tree planting on government lands has continued with the setting out during the month on the Honolulu Watershed forest reserve of 755 koa trees in Manoa valley, and 800 silk oak and 500 swamp mahogany trees on the Kealia reserve, Kauai. The recent plantings here and in Makiki valley have also been gone over to clean out the weeds which have come up with recent rains.

### ARBOR DAY.

Arbor Day was celebrated on November 16 and large consignments of trees were sent to the other islands for planting on this day. Owing to the half-holiday on the same day, on account of the Queen's funeral, the planting on Oahu was not so extensive as on former occasions.

A request has been received from the county engineer of the Island of Hawaii to look into the need for tree planting on the watershed area back of the town of Hilo in order to perpetuate the water supply. This matter will receive attention on my next trip to Hawaii.

## FOREST FENCING.

The building of the fence between the government land of Lāupāhoehoe and the private land of Maulua within the Hilo forest reserve, Hawaii, in coöperation with the Kukaiau ranch, a distance of 2.78 miles, was completed on the first of the month. The very dry summer in this region delayed the operations due to the lack of water and an extension of time on the contract of two months, or until the end of the year, was granted for the completion of the remaining distance of 2.26 miles along the Piha boundary. Since May the tame cattle running loose in the forest reserve in this region have all been removed and over 30 head of wild cattle have been shot by H. Meyer and the Kukaiau ranch under permit from this office. This has tended already to improve forest conditions in this region.

The new fence on the boundary of the proposed Hauula forest reserve, Oahu, was inspected and found to be almost completed. One more small valley and a short stretch up the last ridge will complete the job which is being done by local residents.

## MISCELLANEOUS.

On November 14 and 15 attempts were made in company with the President of the Board to reach Moku Manu off windward Oahu, one of the islands included in Rule IV, in order to place a sign on the island warning against the destruction of birds. Owing to heavy seas and engine trouble it was not found possible to reach the island.

A considerable part of my time during the month has been spent in compiling reports on new forest reserves and other matters which will shortly be presented to the Board for action.

Respectfully submitted,

C. S. JUDD,  
Superintendent of Forestry.

## REPORT OF FOREST NURSERYMAN.

Honolulu, December 11, 1917.

Superintendent of Forestry, Honolulu, T. H.

DEAR SIR:—I herewith submit a report of the work done during the month of November:

## NURSERY.

*Distribution of Plants.*

The distribution of plants, with the exception of a very few orders, were all for Arbor Day planting. A special report on Arbor Day is attached, which contains the number of trees distributed and other information.

## COLLECTIONS.

Collections on account of plants sold.....	\$ .35
Rent of office building, Nursery grounds, September.....	35.00
Total.....	<hr/> \$35.35

*Plantation Companies and Other Corporations.*

The distribution of plants under this heading amounted to 500 pot grown. We have orders on file for 265,000 seedlings to be delivered within the next two months. We are getting all orders ready as quickly as possible.

*Collections and Distribution of Seed.*

The seeding season for most of the forest trees, and also a number of the flowering trees is now on, and the seed boys are busy collecting. From Mr. Van Valkenberg's place at Kunia we collected in one day over three pounds of clean seed of the eucalyptus citriodora and one pound of encalyptus amygdalina. The former is catalogued on the Coast at \$22.00 per pound and the latter at \$14.00.

We had the pleasure of a visit from Mr. George W. Hess, Superintendent of the United States Botanic Garden, Washington, D. C., who accompanied the congressional party. We conducted Mr. Hess to all the places of interest in and around the city. We also gave him a large package of seed containing many species, to take back with him.

*Makiki Station.*

The work at the Makiki Station has been principally routine. We have now gotten rid of a great deal of our surplus stock, and we will be busy at this station now for some time to get a fresh stock up again.

*Honolulu Watershed Planting.*

The work done on the watershed has consisted of hoeing and clearing away brush from the young trees, making holes for planting, etc.

*Advice and Assistance.*

The writer has made visits and otherwise given advice and assistance to people who have asked for same as follows: Visits made to places in and around city, 7; advice given by telephone, 10; advice given by letter, 6; advice given at Nursery, 11.

Respectfully submitted,

DAVID HAUGHS,  
Forest Nurseryman.



## ARBOR DAY.

Honolulu, December 24, 1917.

Superintendent of Forestry, Honolulu, T. H.

DEAR SIR:—I herewith submit a special report on the distribution of plants for Arbor Day planting from the Government Nursery in Honolulu. The total number of plants distributed amounted to 10,490. This is only about one-half the number distributed for the 1916 Arbor Day. The decrease may be due to a number of causes, a few of which are as follows:

1. The school grounds are practically all planted, as far as trees are concerned.
2. The military posts have already planted about all the trees they desire.
3. As to the homesteaders, there have been no new tracts opened up and those homesteaders who have occupied their homesteads for several years have received during that time about all the trees they want.

*Distribution of Plants by Islands.*

Islands.	Plants.
Oahu . . . . .	6,154
Maui . . . . .	2,876
Hawaii . . . . .	1,216
Kauai . . . . .	244
Total . . . . .	10,490

Included in the above total is the number of plants sent to the public schools of the Territory and distributed as follows:

Oahu . . . . .	8 schools	374 plants.
Maui . . . . .	10 "	297 "
Hawaii . . . . .	13 "	431 "
Kauai . . . . .	3 "	62 "
	34 "	1164 "

Reports just received from Bro. Mathias Newell of Hilo and Mr. Walter McBryde of Homestead, Kauai, give the number of trees distributed for Arbor Day planting as follows:

Bro. M. Newell, Hilo . . . . .	334
Mr. W. McBryde, Kauai . . . . .	1,287
Government Nursery distribution . . . . .	10,490
Grand total . . . . .	12,111

Respectfully submitted,

DAVID HAUGHS,  
Forest Nurseryman.

## Division of Plant Inspection

Honolulu, November 30, 1917.

Board of Commissioners of Agriculture and Forestry, Honolulu,  
T. H.

GENTLEMEN:—I respectfully submit my report of the work done by the Division of Plant Inspection for the month of November, 1917, as follows:

During the month there arrived at the port of Honolulu 49 vessels of which 22 carried vegetable matter, one of these vessels passing through the Canal Zone. The consignment consisted of the following:

<i>Disposal</i>	<i>Lots</i>	<i>Parcels</i>
Passed as free from pests.....	1505	45,166
Fumigated .....	8	18
Burned .....	77	78
Returned .....	2	3
Total inspected .....	1592	45,265

Of these shipments 44,838 packages arrived as freight, 223 packages as baggage and 204 packages as mail matter.

### RICE AND BEAN SHIPMENTS.

During the month 15,231 bags of rice and 1,888 bags of beans arrived from Japan and Oriental ports, all of which were free from pests.

### PESTS INTERCEPTED.

Approximately 6,122 pieces of baggage belonging to passengers and immigrants from foreign countries were examined and from these were seized and destroyed by burning 25 lots of fruits and 77 lots of vegetables.

The following disposal was made of plants and seeds from various sources:

November 1, one bag of abaca seed from Manila for the Hawaii Experiment Station was fumigated as a precaution.

November 5, 2 plants found in the baggage of a passenger from Japan were fumigated and the soil removed, in which we found a colony of ants.

November 14, 2 crates of boxtrees from California by express were fumigated. Several garden snails (*Helix aspersa*) were found among the packing.

November 20, 3 packages of staghorn ferns came by freight from Sydney, Australia, also one large fern stump. The ferns

were fumigated as a precaution, but the large stump was refused entry as it showed indications of borers.

November 24, 1 package of Japanese pohu fruit was found in the mail and was returned as contraband.

Two small ornamental plants were found in the baggage from Japan; they were fumigated and all soil removed before delivery. Two packages of tree seed, found in the baggage, were burned as well as a five-needle pine tree, the last being prohibited entry into the United States.

November 30, a package of pine trees from Japan was seized and destroyed by burning.

#### HILO INSPECTION.

Brother M. Newell reports the arrival of six steamers and one sailing vessel with lumber. Two of the steamers carried vegetable matter consisting of 161 lots and 3120 packages. All shipments were passed as free from pests except one sack of turnips which was destroyed on account of being infested with the radish maggot.

#### KAHULUI INSPECTION.

Mr. Edwin C. Moore, acting Fruit and Plant Inspector for Maui, reports the arrival of 6 vessels at the port of Kahului, two of which brought vegetable matter consisting of 13 lots and 699 packages, all of which were passed as free from pests.

#### INTER-ISLAND INSPECTION.

Fifty-seven steamers plying between Honolulu and other island ports were attended to, and the following shipments were passed as free from pests:

Taro . . . . .	571 bags
Vegetables . . . . .	297 packages
Plants . . . . .	218 packages
Fruit . . . . .	18 packages

Total inspected . . . . .	1104 packages
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Seven packages of plants and eleven packages of fruit were seized and refused shipment on account of infestation and undesirable soil.

I beg to inform you that Mr. Will J. Cooper has returned from the training camp and will resume his duties of Plant and Fruit Inspector at Kahului beginning December 1, 1917.

Respectfully submitted,

E. M. EHRHORN,  
Chief Plant Inspector.

## Division of Entomology

Honolulu, November 30, 1917.

Board of Commissioners of Agriculture and Forestry, Honolulu.

GENTLEMEN:—During the month of November the insectary handled 29,400 pupae of the melon fly, from which there were bred 703 females and 675 males, *Opius fletcheri*.

The distribution of parasites was as follows:

*Opius fletcheri*.

	Females	Males
Oahu—Honolulu:		
Makiki . . . . .	30	30
Kailua . . . . .	525	555

*Tetrastichus*.

Oahu: Kalihi . . . . .	700
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*Diachasma fullawayi*.

Oahu: Kalihi . . . . .	85	25
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*Diachasma tryoni*.

Oahu: Kalihi . . . . .	425	240
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*Paranagrus* (Corn Leaf Hopper Parasite).

Oahu—Honolulu:	
Makiki Nursery . . . . .	7700
Kailua . . . . .	2600
Maui—	
Haiku . . . . .	3200

Very respectfully,

DAVID FULLAWAY,  
Entomologist.

## Division of Animal Industry

Honolulu, November 30, 1917.

Dr. Victor A. Nörsgaard, Chief, Division of Animal Industry,  
Board of Agriculture and Forestry, Honolulu, T. H.

SIR:—I have the honor to submit the following report for the  
month of November, 1917:

### TUBERCULOSIS CONTROL.

The following dairy cattle were tested during the past month:

	<i>Tested.</i>	<i>Passed.</i>	<i>Condemned.</i>
S. I. Shaw.....	32	23	9
Girls' Industrial School.....	10	10	0
M. Nee .....	33	32	1
S. Shidara .....	4	4	0
C. Ikeda .....	28	27	1
K. Inouye .....	44	44	0
P. Miyakawa .....	13	13	0
Mrs. C. M. Cooke.....	11	11	0
E. W. Jordan.....	2	2	0
C. W. Lucas.....	1	1	0

The above tabulated list gives a total of 178 head tested, out of which number 167 were passed and 11 condemned and branded.

Besides the above testing, post mortem examinations were made at the local abattoirs on 113 head of cattle condemned for tuberculosis. Lesions of varying extent were found in all animals, but in only one animal were they extensive enough to warrant the condemnation of any parts; in this case both fore quarters were condemned as unfit for human consumption.

Quite a large number of cases of open tuberculosis of the lungs were found among these animals. Such animals have acted as "spreaders," which accounts for the large percentage of infected animals found in some localities.

All the above condemned animals were appraised according to the provisions of Act 121, and the owners have received their full amount of compensation.

### IMPORTATIONS OF LIVE STOCK.

S. S. Makura, Vancouver: 1 large crate white leghorns, Mrs. L. M. Ross.

S. S. Lurline, San Francisco: 58 Holstein cows, 1 Holstein bull, 4 Berkshire hogs, 1 ct. poultry, W. E. Bellina; 1 Berkshire sow, L. K. Smith; 5 Holstein cows, 1 Holstein bull, Lahainaluna School; 30 cts. poultry, various.

S. S. Wilhelmina, San Francisco: 1 dog, W. J. White; 1 cat, Mrs. J. Hickey; 5 cts pheasants, F. F. Baldwin.

S. S. Tenyo Maru, Orient: 1 dog, S. Shigemoto.

S. S. Hyades, San Francisco: 47 Holstein cows, 1 Holstein bull, 1 Berkshire boar, C. H. Bellina.

S. S. Manoa, San Francisco: 13 cts. poultry.

Respectfully submitted,

LEONARD N. CASE,  
Assistant Territorial Veterinarian.

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## Marketing Division

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Honolulu, December 15, 1917.

Board of Commissioners of Agriculture and Forestry,  
Honolulu, T. H.

GENTLEMEN:—I have the honor to submit herewith the financial statement and report of the Superintendent of the Territorial Marketing Division, for the five months ending November 30, 1917:

Since July first, the consignment sales of the Division have been very good and, through the commission earned on these sales and the surplus on hand, it has been possible to pay off all but \$500 of the note for \$3,000 owed on July 1, 1917. The last payment will be made in December. A surplus should then be accumulated to cover the fixtures, autos, etc., listed as assets.

Due to the lack of equipment, poor location of the Division for retailing, and the uncertainty of the supplies that could be sold at retail, the retail departments have not been paying expenses and, with the consent of the Board, they were closed on November 30. The closing of the retail departments will in no way affect the sale of island produce consigned to the Division for sale. In fact it should give the Division more time to sell island produce to wholesalers and the Army at less expense to the Territory and with as good returns to the producer. The force of employees will be reduced to the actual needs of the consignment department at once.

The pineapple crates are being sold just as fast as they can be brought in from Aiea and Wahiawa where they have been stored. When these crates are all sold, the account will probably show a small loss due to the crates rotting while in storage of the Bureau of Immigration and the necessity of selling some of them for less than cost in order to dispose of them. This loss could be made up from earnings. The Attorney General's office states that suit will be brought shortly to collect a claim of \$1651.61, due this account from F. E. Haley. This claim and a few other small

non-collectable claims are included in the reserve for doubtful accounts.

There was not as great a demand for seed from the Division as was anticipated by the last legislature when it made an appropriation of \$2500 and as a consequence there was a lot of seed left on hand at the end of the 1917 planting season.

With the Governor's approval \$688.40 worth of seed was turned over to the Army for the Post garden at Wahiawa on the understanding that the seed was to be paid for out of the crops, if any, either in cash or produce. A report has been requested from the Army on this matter. The other seed on hand is getting old and losing its germination, and I would suggest that it be distributed free of charge if need be in order that it may be of some use to the producers.

The deficit shown in Schedule "C" of the financial statement includes all expenditures from the Territorial expense appropriations and does not represent losses.

Due to the inability of our largest dressed meat consignor to make regular shipments, the consignment sales for December will probably be considerably less than the average for the past few months. There will be a large crop of beans, however, which should be handled by the Division.

Respectfully,

A. T. LONGLEY,  
Superintendent.

SEGREGATION OF PRODUCE RECEIVED BY THE MARKETING DIVISION  
DURING THE MONTH OF NOVEMBER, 1917.

	Total	Oahu	Hawaii	Maui	Molokai	Kauai
Articles:						
Avocados . . . . .	504	..	504	..	..	..
Bananas, bches. . . . .	475	475	..	..	..	..
Beans, dry, sacks. . . . .	156	1	4	151	..	..
Beef, dressed, carcasses	119	5	1	107	6	..
Butter, pounds . . . . .	45	45	..	..	..	..
Cabbage, pounds . . . . .	954	242	712	..	..	..
Chickens . . . . .	210	112	..	51	47	..
Chinese squash . . . . .	10	10	..	..	..	..
Cooking bananas, bches.	6	..	6	..	..	..
Corn, dry, sacks. . . . .	370	..	..	370	..	..
Ducks . . . . .	101	89	12	..	..	..
Eggs, dozen . . . . .	33	33	..	..	..	..
Egg plant, dozen. . . . .	9	9	..	..	..	..
Ginger, pounds . . . . .	80	..	80	..	..	..
Grapes, pounds . . . . .	317	127	190	..	..	..
Hides . . . . .	10	8	1	..	1	..
Hogs . . . . .	16	5	7	4	..	..

Articles:	Total	Oahu	Hawaii	Maui	Molokai	Kauai
Lemons . . . . .	418	418	..	..	..	..
Limes . . . . .	2357	707	1300	..	350	..
Oranges . . . . .	4896	460	4436	..	..	..
Papaia, pounds . . . . .	66	66	..	..	..	..
Peppers, sacks . . . . .	1	1	..	..	..	..
Pigs, dressed . . . . .	9	..	9	..	..	..
Pineapples, pounds . . . . .	1720	1720	..	..	..	..
Pohas, pounds . . . . .	1158	..	1158	..	..	..
Potatoes, white, sweets						
sacks . . . . .	149	149	..	..	..	..
Pumpkins . . . . .	112	109	3	..	..	..
Taro flour, pounds . . . . .	30	30	..	..	..	..
Turkeys . . . . .	12	6	..	..	6	..
Tomatoes, pounds . . . . .	940	940	..	..	..	..
Veal, dressed, carcasses	25	6	2	16	1	..
Yams, red, sacks . . . . .	10	10	..	..	..	..

How the work of the Forest Service was realigned to meet war conditions is described in the annual report of the Forester, made by acting Forester A. F. Potter. The report also states that practically every form of use of the forests was greater than ever before, that the receipts again touched a new high level with a total of \$3,457,028.41, and that the increase in receipts over the previous year was \$633,487.70.

Under the provisions of the national forest section of the Federal Aid Road Act approximately \$1,410,000 of Federal Aid road money is available during the next ten years, at the rate of \$141,000 a year, for the construction of roads and trails within the national forests of California. In each case, under the terms of the Act, the road funds must be derived partly from local sources.

A 14-lb. Christmas box for each member of the Forest Service from California in France with the 10th Engineers, the Lumberjack and Forestry regiment, was shipped from the San Francisco office of the Forest Service. Each box contains candy, tobacco, cigarettes, toilet articles, raisins and dates, a pipe, deck of playing cards, a book, and a waterproof match safe. These boxes are being sent by former associates of the men in the Forest regiment.

The yucca plant or Spanish bayonet, common in the hills of southern California, is now being used for the manufacture of brooms. Another species of the yucca is used for the manufacture of surgeons' splints, and is being experimented with for use as artificial limbs.

The common manzanita bush, grown everywhere in California, may be of value in dye-making. A carload of stems and roots



was recently shipped from northern California to an eastern dye manufacturer for experimental purposes.

The root swellings or burls of the wild lilac are proving valuable as a substitute for briar in the manufacture of tobacco pipes.

Bay rum, used in toilet preparations, is manufactured from the California bay tree, and quinine is produced from the wild quinine bush that grows widely over the southern deserts.

On December 5, 1917, a proclamation was signed by the President eliminating approximately 431,000 acres from the Sequoia national forest, California. The greater portion of the lands eliminated comprise three large tracts situated at the southern end of the forest. Of the entire area eliminated from the forest about 20,000 acres are shown by the classification reports to have agricultural value, and it is believed that considerable of this land will be filed upon in the near future.

### THE MANGROVE IN THE HAWAIIAN ISLANDS.

By VAUGHAN MACCAUGHEY, *College of Hawaii.*

One of the most abundant and characteristic trees along tropical and subtropical coasts, throughout the world, is the mangrove. This tree possesses a number of highly interesting peculiarities. It grows in salt water. It forms impenetrable thickets with its branching aerial roots. It does not have true seeds, but is viviparous, and the young plants are remarkably adapted for life in their marine nursery.

The mangrove is a notable land-builder. It has added thousands of miles of *terra firma* to the coast lines which it inhabits. The writer, who has been interested for the past decade in the natural history of Hawaii, has often deplored the absence of mangrove swamps in the Hawaiian Archipelago, both from the economic standpoint, and from the standpoint of the general natural history interest of such a life zone. The absence of the mangrove from Hawaii is another evidence of the profound isolation of this archipelago through long periods of time. The coasts of the Hawaiian Islands, both naturally and as a result of the devastations of man and his live stock, are singularly barren of arborescent vegetation.\* There are extensive areas, particularly on the islands of Kauai, Oahu, Molokai and Maui, that are admirably adapted to the mangrove, and that would be greatly benefited by the presence of this valuable land-building tree.

The mangrove tree is not generally known to be introduced into the Hawaiian Islands. The writer by chance discovered a

\* See MacCaughey, Survey of the Hawaiian Land Flora, Botanical Gazette, August, 1917.

fine specimen growing in a fish pond, at the Kalihi Farm, near Honolulu, belonging to the Alexander Young Estate. This tree was planted by Mr. Allan Herbert, many years ago, and is now in flourishing condition. So far as is known to the writer, it is the only tree on the Island of Oahu. Under the direction of Mr. George Cooke there have been extensive plantings of mangrove along the shores of the Island of Molokai. The trees were planted as a source of floral honey, as Molokai is a noted honey-producing region. The trees are spreading and seeding and rapidly becoming thoroughly naturalized. The mangrove is not mentioned by Hillebrand, or by any other of the many botanists who have visited and written of the native and naturalized plant life of Hawaii. The tree specified is not only in vigorous growth, but has produced many seedlings which have evidently become thoroughly naturalized. The evidence strikingly corroborates the writer's previous conviction as to the Hawaiian possibilities of the mangrove.

The family Rhizophoraceæ, of which the mangrove is characteristic, comprises 15 genera and about 50 species. Prominent among the genera are: *Weihea*, 12 spp., Old World tropics; *Ceriops*, 2 spp., Old World tropics; *Pruguiera*, 5 spp. tropical Asia and East Africa; *Anisophyllea*, 5 spp., Old World tropics; *Poga*, 1 spp., Africa. *Rhizophora* has 3 species, *mangle*, of tropical America and West Africa; *mucronata* and *conjugata*, of tropical Asia and East Africa. These three are widely distributed on the shores of tidal marshes and estuaries. The generic name is from the Greek, root-bearing, and was used by early writers to designate various climbing plants with aerial roots.

The genus is almost unique in the plant world because the seeds have no true resting period, that is, they germinate at once on the plant. The radicle may reach a length of 3 feet, although usually less; it is club-shaped and heaviest at the apex, so that when the seedling finally falls from the tree, it sticks vertically in the mud, with the radicle down, ready to grow. This is one of the best examples of vivipary, as the embryo continues in a state of uninterrupted development from the outset. This is essentially seedlessness, from the physiological standpoint, and germination, in the usual sense, does not take place. This habit is of obvious usefulness, facilitating both the wide dispersal and abundant reproduction of these plants, as is testified by the extensive coastal mangrove swamps throughout the tropics. This extraordinary combination of structural and ecologic characters—vivipary, aerial roots, ability to grow in salt water, rapid lateral growth, and freedom from fungus and insect pests—has given to the mangroves a tremendous advantage in the invasion of tropical coasts.

The name mangrove is derived, by corruption, from the original Malayan name *mangi-mangi*. The American species, *R. mangle* L., is called Red Mangrove, referring to the color of the inner bark. There are various trees in other regions that are

called mangrove, that are not true mangroves, and do not belong to the mangrove family. The White "Mangrove" is *Laguncularia racemosa* of tropical America. The Black Mangrove is *Avicennia nitida*, also of tropical America, and sometimes called Olive Mangrove. The Mangrove Myrtle is *Barringtonia acutanguta*, of the East Indies. The Milky Mangrove is *Excaecaria agallochum* of Australia. The Tasmanian "Mangrove" is *Acacia longifolia*. The River Mangrove is *Aegiceras majus*, of Indo-Malaya and Australia.

The American mangrove, which is the species represented in the Hawaiian Islands, is abundant along the coasts of Florida, tropical America, the West Indies, and the Galapagos Islands. It forms vast, monotonous green thickets, and is the van of advancing vegetation along the salt marshes. Its maze of roots make it an effective land builder, and it rapidly gives a foothold to less hardy species. In West Indian waters, for example, mangrove islands are formed so rapidly that in a few years they dot the shallow waters of bays which were formerly destitute of them.

The tree is round-topped, bushy, and usually 15-20 feet high. Its branches are spreading, like those of the *hau*, and its roots make almost impenetrable thickets. Sometimes, in inland situations, the tree grows erect, attaining a height of 70-80 feet, with a fine tall straight trunk, 3-4 feet in diameter, and clear of branches for more than half its length. These trees, of course, yield the best timber. Normally, however, the tree is squat and broad, and as it grows it throws out great numbers of aerial roots, which brace it well on all sides, like those of the *Pandanus* or *Banyan*, so that the waves and tides cannot dislodge it. The roots branch profusely in the air and spread out laterally, forming a dense network. They are of special importance in supporting the numerous branches, as in most cases the basal part of the primary trunk has an early death. The roots themselves are very stem-like in internal structure. The aerial roots or pneumatophores comprise an interesting feature of this tree. These are erect or kneed branches of the roots, which project above the mud, and are provided with stomata and lenticels, into which air passes freely and is then carried by means of passages in the soft spongy tissues to the underground roots. Like certain other aquatic plants, the mangrove develops intercellular or internal hairs in its air-passages. These hairs are of ecological significance in connection with the fluctuations in the air-supply, which varies greatly, of course, with the rise and fall of the tides.

The bark is at first smooth, reddish brown, becoming .35-.50 inch thick, and gray faintly tinged with red. The surface is irregularly fissured into low close ridges, these again are transversely broken into thin appressed scales, giving a very characteristic appearance to the old bark. The bark is red inside. It is rich in tannin, and is used for tanning leather, and also in dyeing. The Florida Indians formerly used the copious bast for

an excellent cordage. A decoction of the bark is used by the natives of tropical America as a febrifuge.

The wood is very heavy, weighing 72.40 lbs. per cubic foot of seasoned wood. It is very hard, tough, strong, and durable. It is close-grained, and takes a beautiful satiny polish. The heartwood is dark-reddish-brown streaked with lighter brown; sometimes it is almost black. The sapwood is pale, with 40-50 seasonal rings. The pith rays are thin and broad; the ducts are open and diffuse. The following table will show the mechanical properties of the wood:

Specific gravity .....	1.617
Percentage of ash.....	1.82
Relative approximate fuel value.....	1.1406
Coefficient of elasticity.....	165567
Modulus of rupture.....	1207
Resistance to longitudinal pressure.....	860
Resistance to indentation.....	462

The wood makes an excellent fuel. As it is not attacked by teredos, it is sometimes used for wharf pilings. It also has been used for flooring. The mangrove, however, grows in situations that render very difficult the cutting and transportation of the wood, and it is of little commercial importance.

The young branches are stout, terete, conspicuously marked by the large, oval, slightly elevated leaf-scars. The leaves are opposite and stipulate. The stipules are interpetiolar, lanceolate, acute, 1.5-2 inches long, glabrous, light green, infolding the bud, and deciduous as the leaf unfolds. The terminal bud is strong and conspicuous. The leaves are 3.5-5 inches long and 1-2 inches wide. The petioles are 0.5-1.5 inches long, smooth, light green, and flattened. The blade is oblong, oval, or elliptical. It is glabrous, thick, and coriaceous. The apex is rounded or acute; the base is cunette, narrowing gradually. The margin is entire and slightly thickened. The upper surface is dark green and very glossy; the lower surface is pale, but veinlets are rather obscure, reticulate. The leaves are persistent for 1 or 2 years. It is interesting to note that the old leaves serve as water-storage organs. The old, yellowish leaves are twice as thick as leaves which have just attained their full size, and the former are notably charged with water.

The flowers are small, dull colored, and not particularly conspicuous. They are produced continuously throughout the year in the axils of the young leaves. They are borne on stout 2- or 3-branched peduncles 1.5-2 inches long. Each pedicel is subtended by a 2- or 3-lobed involucre cup at the end of the peduncle. Each flower has 2 short bracelets united in an involucre cup. The flowers are perfect, regular, and when fully expanded are about 1 inch in diameter. The calyx is coriaceous; lobes 4; 2-3 times as long as the turbinate, globose tube; each lobe acute, thickened at the margins and with a median rib on the inner sur-

face; persistent; reflexed at maturity. The petals are 4; induplicate in the bud; inserted on a fleshy disk-like ring in the mouth of the calyx tube; nearly linear, cleft at the tip; pale yellow; coated on the inner surface with long pale hairs; reflexed between the calyx-lobes at maturity, and early caducous. The stamens are 8-12 in number, in 2 sets; filaments villose, very short or none; anthers attached at the base, elongated, introrse, connivent, and areolate. The ovary is conic, partly inferior, and 2-loculed. There are 2 awl-shaped, spreading styles, stigmatic at their tips. The nectaries are well-developed, and the flower is an important source of honey.

The fruit is berry-like, 1 inch long, conical, rusty-brown, leathery, and slightly studded with minute bosses. It is normally 1-celled and 1-seeded. It is subtended by the persistent reflexed calyx-lobes, and perforated at the apex by the germinating embryo. The fruit is said to be sweet and edible, and its juice, when fermented, yields a light wine. The apex of the seed is surrounded by a thin, albuminous, cup-like aril. The cotyledons are dark purple. The embryo is surrounded by a thin coat of albumen. The seed coat is thick and fleshy.

As already has been indicated, the viviparous habit is one of the remarkable features of the mangrove. The embryo has no true resting period. Upon the maturity of the fruit the cotyledons develop as a slender, hard, woody, thick-walled tube, protruding 0.5-.75 of an inch beyond the apex of the fruit. The plumule is enclosed within this tube. The radicle is elongate and club-shaped and grows pendulously from the tube. It is dark-brown, marked with occasional orange-colored lenticels. It rapidly enlarges and becomes the most conspicuous part of the reproductive mechanism. When mature it is 10-12 inches or more long, and .25-.35 of an inch in diameter near the apex. It drops from the cotyledon tube which has supported it. The heavy, club-shaped apical end sticks into the mud, and the lighter basal end, bearing the plumule, is uppermost. The plumule is thus held above the surface of the shallow water; the radicle strikes root; and the seedling quickly establishes itself. If the water is deep, or there are currents, the nautical seedling may float unimpaired for great distances before finally reaching shallow water where conditions permit a continuation of its growth processes.

There is abundant evidence that the mangrove, if once suitably established on the shores of the Hawaiian Islands, would in time become one of Hawaii's most important littoral trees.

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Editor Hawaiian Forester.

Dear Sir:—Will you please append the following statement, by Mr. George P. Cooke, of Molokai, to my article upon the Mangrove in Hawaii. In kind response to my inquiry, Mr. Cooke wrote December 15 in part:

"In reply to your favor of recent date re mangrove trees, will

say that the first trees planted on the Molokai Ranch were set out before I came to the ranch in 1908. One of our men, Mr. James Munro, informs me that they were set out about the year 1905. The trees are from seed that came from Florida. They now cover thinly about one mile of the shore. The planting of the trees was for the purpose of holding back soil that is being washed down by every heavy rain into the sea, and also as a pasture plant for bees. I do not know of any other trees in the Islands. In 1908 shortly after I came to Molokai we received a lot of seed of the Philippine mangrove. These had been shipped on a transport but were not landed till the steamer returned to Honolulu from San Francisco. None of these germinated.

"I have found volunteers from our trees growing along the shore about five miles away. And the other day I found two healthy seeds on our windward shore, to reach which the seeds must have drifted on the currents at least sixty miles."

## THE PINEAPPLE GUAVA.

### A DELICIOUS SUBTROPICAL FRUIT.

By VAUGHAN MACCAUGHEY, *College of Hawaii.*

The true guavas (*Psidium*) are widely known and enjoyed throughout tropic and subtropical regions, both as fresh fruit and in the form of jam, jellies, etc. Closely related to them, however, is a little-known species, the Pineapple Guava, *Feijoa Selowiana*.

This species is native to subtropical South America, particularly western Paraguay, southern Brazil, Uruguay, and parts of Argentina. In these countries it is common in the forests. Although not cultivated by the natives, the fruit is highly prized by them. The designation Pineapple Guava refers to the flavor of the fruit, which strongly resembles that of the pineapple. It is also called Brazilian Guava or Fig Guava. It is not listed in Wilder's book on Hawaiian fruits.

It was named by Berg (Martius, *Flora Braziliensis* XIV, 1, p. 616, 1858), after material collected by Friedrich Sellow in Brazil. The genus was dedicated by Berg to Joam de Silva Feijoa (correctly pronounced fay-zhó-a), director of the Museum of Natural History at San Sebastian, Brazil. The first complete and accurate description of the species was not made until forty years later, by Dr. Edouard André, in *Revue Horticole* 70:265. 1896. Two other species have been described—*F. obovata* Berg and *F. Schenckiana* Kiaersk, but the fruit of both these are unknown. The genus is closely allied to *Psidium*, but distinguished from it by albuminous seeds and stamens suberect in the bud.

The only general account in the American literature is that of F. W. Popenoe, in the *Pomona College Journal of Economic Botany* 2 (1912) No. 1, pp. 217-242, 13 figs., but this journal had a limited circulation and has been defunct for several years. The

fruit was unknown in the Hawaiian Islands previous to 1908, and the present account is the first to emphasize its possibilities in this Territory of the United States. It is cultivated in the Hilo region, Hawaii. The College of Hawaii has nursery plants.

The Pineapple Guava was introduced into Southern Europe in 1890, and is grown in southern France and Italy. From Italy it was introduced into the United States in 1900. It has been widely planted in California; in 1908 the Hawaii Agricultural Experiment Station received plants from southern California, and these have grown satisfactorily. The tree itself is well adapted for use as an ornamental and as a hedge-plant; the fruit is of unusual horticultural promise. There are now on the market several named varieties, of which André, Hehre, and Besson are the best known.

The shrub attains a height of 10-15 feet. Very old plants may have a total spread of 18 feet or more, with trunks 8-10 inches thick at the base. The branches are rounded and swollen at the nodes. The bark is light gray; the entire plant, with the exception of the upper surfaces of the leaves and the corollas, is covered with white tomentum. The leaves are opposite, short petioled, thick and coriaceous. They resemble those of the olive, but are much larger. The upper surface is dark glossy green; the lower surface is silver gray, canescent and finely pubescent. The striking contrast in the two surfaces constitutes one of the ornamental features of the plant. The margins are slightly recurved. The veins are inconspicuous on the upper surface of the blade; below they are fine, prominent, and in arcuate reticulations, re-uniting before reaching the margin of the leaf.

The flower buds are globular, puberulent, and constricted above the ovary. The flowers are showy (1-1.5 inches diameter), red, white and purple, bisexual, and solitary or in clusters. They appear in late spring. The pedicels are 1-flowered at the ends of the branches or becoming lateral. They are at first straight, then recurved, .50-.75 inch long, whitish and velvety. The calyx tube is turbinate. The sepals are 4, unequal, obtusely elliptical, recurved; pubescent, and ciliated. The petals are 4, spreading, thick and fleshy, ovate or obovate, entire or emarginate, obtuse, glabrous and ciliated. They are cupped, white on the outside and purplish crimson within. After anthesis they become recurved. They have a sweet flavor.

The stamens are numerous, perigynous, erect in a large cluster of many series, about 1 inch long. The filaments are showy, filiform, deep purple or crimson red. The anthers are globular and yellow. The style is longer than the stamens, filiform, and with a capitate stigma. The ovary is 4-celled, oblong, turbinate. The flower as a whole is very attractive, with plentiful nectar, pollen and aroma; a bush in full blossom is handsome to a marked degree.

It has been demonstrated that the flowers of the Pineapple Guava are largely self-sterile, and although isolated plants are not infrequently productive, it is good horticultural practice to

plant two or more bushes together so as to permit cross-pollination. For a detailed statement of these investigations see K. A. Ryerson, in *University of California Journal of Agriculture* 2 (1914) No. 2, pp. 51-53.

The fruit is a berry, oblong or oval, 2 inches long and 1.5 inches in diameter (there is considerable variation in size), with 4 many-seeded locules. When mature it is characterized by a delicious penetrating odor. The surface is at first tomentose, then smooth. The fruit is crowned by the thick disk and cupped sepals of the persistent calyx. The skin is much indented, slightly and unequally furrowed, but upon maturity becomes smooth. In color it is dull green, sometimes flushed with crimson on one side. The green color is retained at maturity. The flesh comprises a firm, whitish, granular layer which surrounds the central pulp. This pulp is thick, creamy yellow or translucent, and melting. It possesses a delicious flavor, strongly resembling that of the fully matured pineapple, with a rich heavy bland perfume. In the pulp are 20-30 very small oblong seeds, so small as to be unnoticed in eating the fruit, and contrasting with the seedy interior of the common guava.

The fruit should not be picked until it is fully mature. It ripens in autumn and early winter, and falls to the ground upon maturity. The ripe fruit should be laid in a cool place until ready for eating. Little care is required in packing; the fruit is an excellent shipper if it is kept cool. It quickly spoils in a hot, humid atmosphere, but can be kept for a month or more if suitable conditions are maintained. The fruit is not only delicious when eaten out of hand, but also can be cooked, crystallized, and made into jams or jellies.

A notable feature of the Pineapple Guava is that it grows better under subtropic conditions than in strictly tropical regions. It is hardier than most of the fruits found in the Hawaiian Islands, such as the mango, avocado, papaya, etc. The best climate for the Pineapple Guava seems to be one free from excessive moisture and cool for at least a portion of the year. In France the Pineapple Guava has passed uninjured through temperatures of 12° F. It would probably thrive in the upland regions of Maui and Hawaii, as well as on cool parts of the Kauai and Oahu lowlands. The plant is notably drought resistant, and contrasts strongly in this respect with many other tropical fruits. It requires very little pruning or other attention.

Propagation is usually by seed, which comes fairly true. The seedlings come into bearing in 3-5 years. Cuttings of the young wood are successfully rooted under glass, with bottom heat, although they root very slowly. Layering is used in France and other parts of southern Europe to propagate choice varieties. The layers root in about six months.

The Pineapple Guava offers very attractive possibilities to all who are interested in tropical and subtropical horticulture. There is no question but that in time it will make for itself a large and unduplicated place in the horticulture of the Hawaiian Islands, southern California and tropical Florida.



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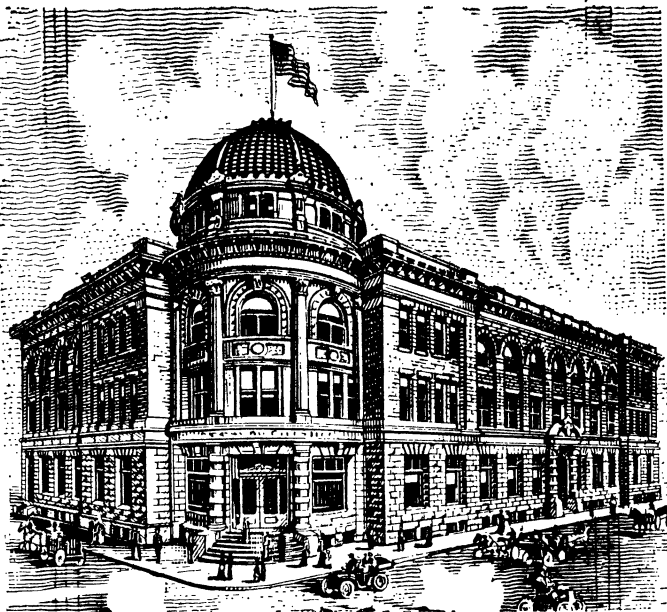
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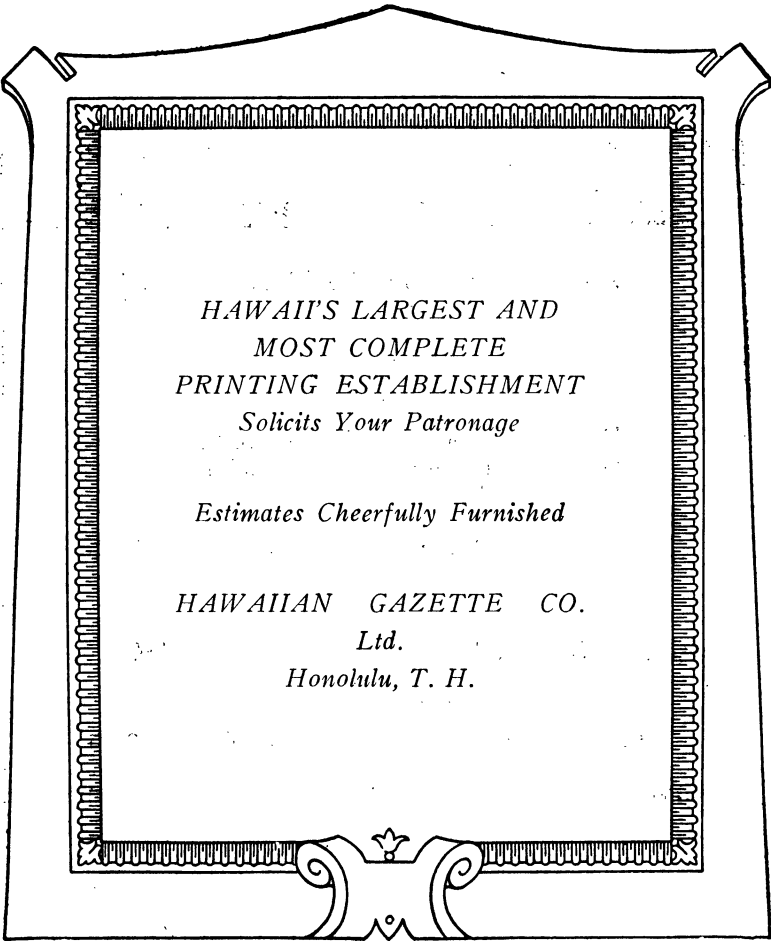
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